INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2006/08–6–801–804
http://www.fspublishers.org

Impact of Various Concentrations of Insecticide (Methamidophos) on the Insect Control, Seed Yield and Economics of Mungbean (*Vigna radiata* L.)

RAHMAT ULLAH KHAN[1], DOST MUHAMMAD† MATIULLAH KHAN AND MUHAMMAD SOHAIL KHAN‡
Arid Zone Research Institute (AZRI), Ratta Kulachi D.I. Khan - Pakistan
†*Department of Soil and Environmental Sciences, NWFP Agricultural University - Pakistan*
‡*Horticulture Section, Agricultural Research Institute (ARI), Ratta Kulachi D.I. Khan - Pakistan*
[1]Corresponding author's e-mail: drrukhan@yahoo.com

ABSTRACT

The research studies were conducted to evaluate the impact of various concentrations of insecticide (methamedophos) on the insect control, seed yield and economics of mungbean at the research Farm of Arid Zone Research Institute, Dera Ismail Khan during two years viz. 2004 and 2005. The treatments consisted of 500, 750, 1000, 1250 mL ha^{-1} of methamedophos including control. The data revealed that generally all the concentration levels of methamedophos positively controlled the short horn grass hopper attack (reduced its infestation level) and affected the yield components and seed yield kg ha^{-1} except maturity but the above parameters were significantly increased as 25% branches plant^{-1}, 42% pod plant^{-1}, 15% grain pod^{-1}, 8.3 g seed weight and 48% seed yield over control plots @ 1000 mL ha^{-1} during kharif 2004, although it did not differ significantly with highest level of 1250 mL ha^{-1}. During kharif 2005 the said level of concentration @ 1000 mL ha^{-1} gave significant increase of 29% in plant height, 106% branches plant^{-1}, 45% pod plant^{-1}, 12% grain pod^{-1}, 9.8% g seed weight and 45% seed yield kg ha^{-1} over control. Minimum insect infestation was observed when methamedophos was applied @ 1000 mL to 1250 mL ha^{-1} as compared to control that showed maximum infestation. The highest cost benefit ratio of Rs. 1:16 and 1:10 was recorded @ 1000 mL ha^{-1} of methamedophos during both the years, respectively. These results suggest that methamedophos @ 1000 mL ha^{-1} is the best economical rate for getting maximum insect control, seed yield and net crop return.

Key Words: Mungbean; Insecticide (Methamedophos concentrations); Insect control; Seed yield; Economics returns

INTRODUCTION

Mungbean (*Vigna radiata* L.) is commonly known as mung. It belongs to family leguminocea. It is important pulse crop rich in protein, calcium, phosphorus and vitamins (Ashique, 1993). It restores the fertility of soil by fixing the atmospheric nitrogen through root nodules and nitrogen fertilizer is usually not applied as a legume it fixes it own nitrogen but it is advisable to use Rhizobium inoculum on the seed, particularly when the crop is to be grown in a field that has not been sown to mungbean for several years, (Bruce, 1997). It has been reported that the net benefits of legumes are often equivalent to the addition of 50 - 100 kg N ha^{-1} as fertilizer (Herridge *et al.,* 1993). In Pakistan, it is grown an area of about 255.9 thousand hectares with the total annual production of 140.7 thousand tones and average yield 550 kg ha^{-1} (MINFAL, 2004). The production of mungbean is still very low as compared to other developed countries due to various constraints. Being leguminous crop, poor crop establishment is often cited as a major constraint for mungbean production (Naseem *et al.,* 1997; Kirchof *et al.,* 2000; Rahmianna *et al.,* 2000). Among them insect/pests also severely damage the crop growth and its yield as per their infestation. About 128 species of insects have been reported attacking the crop (Nazir *et al.,* 1994). But grass hoppers are also major pest of cultivated crops. The primary injury caused by grass hopper is defoliation, as they consume clip foliage as they feed (Gary & Cambell, 2004). They eat 30 - 100 mg of plant material (dry weight) each day but it has been shown that even a moderate infestation of 10 grass hoppers/square meter can typically consume up to 60% of the available forage (James & Johnson, 2003).

Keeping in view the importance of leguminous crop, the present study was carried out to find out the optimum level of insecticide (*methamedophos*) for efficient insect control, obtaining maximum yield and its monetary return in mungbean.

MATERIALS AND METHODS

The research studies to evaluate the impact of various concentrations of insecticide (*methamedophos*) on the yield and economic return of mungbean were conducted at Arid Zone Research Institute (AZRI) during Kharif 2004 and 2005. The study comprised of following five treatments:

T_1 Control
T_2 500 mL *methamedophos* ha^{-1}

T_3 750 mL *methamedophos* ha^{-1}
T_4 1000 mL *methamedophos* ha^{-1}
T_5 1250 mL *methamedophos* ha^{-1}.

The experiment was laid out in randomized complete block design (RCBD) with three replications with a plot size of 3.5 x 5 m^2 on already grown mungbean for general cultivation at AZRI farm. The mungbean cv. NM-92 was sown on 19th and 20th June during 2004 and 2005. After a thorough seed bed preparation, nitrogen and phosphorus @ 20:50 kg N and P_2O_5 ha^{-1}, respectively was applied at field capacity with drill having 40 cm row spacing and 20 kg ha^{-1} seed rate. After crop emergence, short horn grass hopper's initial infestation was started with gradual increase in the population day by day. However, before applying the insecticide (methamedophos), (05) randomly selected plants were taken from each plot per year to determine its intensity of damage in shape of holes formed on its leaves. There were more holes (about 2/3) of all holes in plant. After the said assessment, 30 days old mungbean crop was sprayed at various concentrations with the knapsack sprayer. After 20 days of spraying, 10 plants were randomly selected per treatment and (05) central leaves per plant were taken to determine the response of methamedophos towards control of insect attack in terms of holes infestation. At maturity 10 plants were randomly selected in each treatment to measure data on plant height, branches $plant^{-1}$, pods $plant^{-1}$, grain $pods^{-1}$ and 1000 seed weight. While centrally four rows in each treatment were harvested and threshed manually to measure the seed yield kg ha^{-1}. Recorded data were analyzed statistically using analysis of variance technique (ANOVA) and means were compared by Duncan's multiple range test (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

Plant height. Plant height showed a significant response to different treatments from 67.13 in control plots to 73.80 cm (10% more over) in treatment receiving insecticide @ 1250 mL ha^{-1} during the years 2004 - 05. Similar trend appeared in 2005 as the same treatment produced the taller plants (91.5 cm) as compared to (65.2 cm) in control plots, while the said treatment did not differ significantly than the rate of 1000 mL ha^{-1}. This increase over control contributed 10% and 14% during both the years, respectively (Table I & II).

Branches $plant^{-1}$. Data on number of branches varies from 2 to 3 $plant^{-1}$ and 1 to 3 $plant^{-1}$ during 2004 and 2005, respectively. This increase in branches occurred gradually with an increase in the rates of application. The significantly highest number of branches (3) $plant^{-1}$ produced with in the insecticide rate of 1000 mL to 1250 mL ha^{-1}, which was 25 to 30% higher over control during 2004 and 2005. Similarly 106 to 113% increase occurred over control plots with the said levels of concentration during 2005 - 06. Significantly it did not differ among these two levels both the years, respectively (Table I & II).

Pods $plant^{-1}$. Results concerning the number of pods per plant showed significant variations ranging from 12 to 17 and 10 to 15 with different levels of concentration during 2004 and 2005. The insecticide sprayed @ 1250 mL ha^{-1} significantly produced the highest numbers of pods (17) among the treatment apart from 1000 mL ha^{-1}, which produced almost the same number of pods (16.9) $plant^{-1}$. This increase appeared 42% over control during 2004 (Table I). During 2005 number of pods per plant ranged from 10 to 15. The highest number of pods (15) was obtained @ 1000 mL ha^{-1} application of insecticide with an increase of 45% more pods over control (Table II). Also it did not differ significantly than the methamedophos level of 1250 mL ha^{-1}.

Grains pod^{-1}. Concerning to grains pod^{-1} varied from 9.3 to 10.7 during 2004 and 11 to 12.4 during 2005 for different treatments (Table I & II). The highest number of grains pod^{-1} as 10.7 and 12.4 were recorded in treatment receiving insecticide @ 1000 mL ha^{-1}, which was followed by non-significant value of 10.6 grain pod^{-1} received at 1250 mL methamedophos ha^{-1} (Table I). During 2005 the same methamedophos concentration of 1000 mL ha^{-1} produced the highest number of grain pod^{-1} among the treatments as shown in (Table II). Both these higher grains pod^{-1} @ 1000 mL ha^{-1} advocate for better insects control to get maximum yields. The said treatment increased the grain pod^{-1} 15% and 12% over control plots both the years, respectively.

1000 Seed weight. Results of the data on 1000 seed weight showed a significant effect of different treatments. All the insecticide treatments significantly increased the seed weight over control during 2004 and 2005. However the highest values of 47.67 and 43.69 g weight over control were recorded in the treatment receiving the insecticide rate 1000 mL ha^{-1} among the treatments both the years, respectively. This increase over control plots appeared 8.3% and 9.8%, which shows its positive effect on plant growth leading towards maximum seed yield, obtaining (Table I & II).

Seed yield. Seed yield (Kg ha^{-1}) showed a significant response to different treatments ranging from 808 to 1197 and 487 to 708 kg ha^{-1} both the years, respectively. It was observed that seed yield positively increased with an increase in insecticide levels but the maximum seed yield increase 1197 kg ha^{-1} and 708 kg ha^{-1} were obtained with the receiving of 1000 mL ha^{-1} of insecticide (methamedophos) during 2004 and 2005, pertaining to 48% and 45% increase over control plots, respectively (Table I & II). During the year 2004, although the said level did not increase the seed yield significantly than the treatment receiving 1250 mL ha^{-1} methamedophos but economically 1000 mL ha^{-1} appeared the best level for obtaining highest seed yield among the other treatments evaluated under the study both the years, respectively. It might be due to its positive affect towards reduced grass hopper infestation (Fig. 1).

Economic return. Concerning to methamedophos impact regarding to its economic return, all the levels gradually increased the cost benefit ratio over control plots during both the years 2004 and 2005, respectively (Table III & IV). But the highest benefit 1:16.7 and 1:9.5 were obtained with the methamedophos concentration of 1000 mL ha^{-1} among the other treatments both the years, respectively as depicted in (Fig. 2).

CONCLUSION

It has been concluded from the results obtained from two years study that insecticide (methamedophos) sprayed @ 1000 mL ha^{-1} appeared the best level, which reduced short horn grass hopper's infestation in term of damaging the plants leaves by making holes on it and resulting in to maximized yield components and seed yield. Moreover, it

Table I. Impact of various concentrations of methamedophos on insect control and seed yield of mungbean during Kharif 2004

Treatment s (ml ha^{-1})	Insect Inf. (holes $Plant^{-1}$)	Plant Height (cm)	Branches $Plant^{-1}$	Pods $Plant^{-1}$	Grains Pod^{-1}	1000 Seed Weight (gm)	Maturity	Seed Yield (kg/ha)
Control	40.0 a	67.13 b	2.10 c	11.9 c	9.3 d	44.00 d	77	808 b
500	31.0 b	68.53 b	2.37 b	14.8 b	9.7 c	46.00 bc	77	867 b
750	28.0 c	67.67 b	2.47 b	14.9 b	10.5 b	45.67 c	77	933 b
1000	10.0 d	68.33 b	2.63 a	16.9 a	10.7 a	47.67 a	76	1197 a
1250	9.0 d	73.80 a	2.73 a	17.0 a	10.6 ab	47.33 ab	76	1121 a
LSD(0.05)	2.0	4.33	0.13	1.7	0.1	1.61	N.S.	172

Means followed by same letter(s) do not differ significantly at P<0.05

Table II. Impact of various concentrations of methamedophos on insect control and seed yield of mungbean during Kharif 2005

Treatments (ml $ha^{-1)}$	Insect Inf. (holes $plant^{-1}$)	Plant height (cm)	Branches $plant^{-1}$	Pods $plant^{-1}$	Grains pod^{-1}	1000 seed weight (gm)	Maturity	Seed yield (kg/ha)
Control	62 a	80.0 d	1.5 c	10.3 e	11.1 c	39.80 d	77	487 d
500	47 b	86.7 c	2.1 b	12.6 d	11.7 b	40.64 c	77	565 c
750	32 c	88.9 b	2.4 b	13.4 c	12.2 b	41.69 b	77	644 b
1000	15 d	91.4 a	3.1 a	14.9 a	12.4 a	43.69 a	77	708 a
1250	14 d	91.5 a	3.2 a	14.2 b	11.9 b	43.15 a	77	651 b
LSD(0.05)	4.0	1.8	0.3	0.6	0.4	0.82	NS	34

Means followed by same letter(s) do not differ significantly at P<0.05

Table III. Impact of various concentrations of methamedophos on the economic returns of mungbean during Kharif 2004

Treatments (ml ha^{1})	(1) Gross Return (Rs ha^{-1})	Net Yield Increase (kg ha^{-1})	(2) Variables Cost (Rs/ha)	(3) Net Value (Rs)	(4) Value/Cost
Control	12120	-	-	12120.0	-
500	13005	59	225.0	12780.0	1:3.9
750	13995	125	287.5	13707.5	1:6.5
1000	17955	389	350.0	17566.0	1:16.7
1250	16815	313	412.5	16502.0	1:11.4

1. Mungbean market price Rs.15/kg
2. Insecticide (*methamedophos*) price Rs.250/lit+spray+labour cost Rs.120/ha
3. Net value = gross return-variable cost
4. Value/cost = value of additional seed production/cost of obtaining extra yield

Table IV. Impact of various concentrations of methamedophos on the economic returns of mungbean during Kharif 2005

Treatments (ml ha^{1})	(1) Gross Return (Rs ha^{-1})	Net Yield Increase (kg ha^{-1})	(2) Variables Cost (Rs/ha)	(3) Net Value (Rs)	(4) Value/Cost
Control	4305	-	-	7305	-
500	8475	78	225.0	8250	1:5.2
750	9660	157	287.5	9373	1:8.2
1000	10620	221	350.0	10270	1:9.5
1250	9765	164	412.5	9353	1:6.0

1. Mungbean market price Rs.15/kg
2. Insecticide (*methamedophos*) price Rs.250/lit+spray+labour cost Rs.120/ha
3. Net value = gross return-variable cost
4. Value/cost = value of additional seed production/cost of obtaining extra yield

Fig. 1. Impact of various concentrations of methamedophos on insect infestation of mungbean during Kharif 2004 and 2005

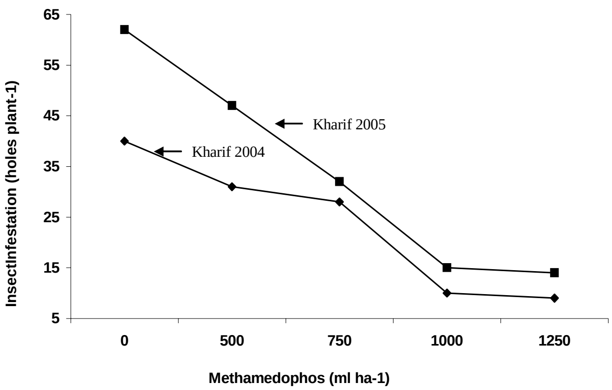
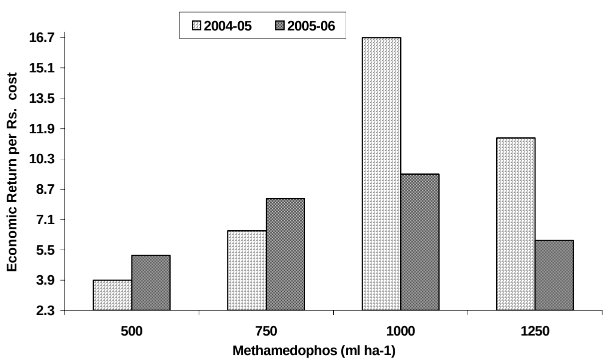


Fig. 2. Impact of various concentrations of methamedophos on economic returns of mungbean during Kharif 2004 and 2005



also appeared economical by giving maximum VCR of 1:17 and 1:10 among the treatment under the agro-climatic conditions of D.I. Khan.

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(Received 28 February 2006; Accepted 10 September 2006)